

AFIT/GOA/ENS/97M-09

A DECISION SUPPORT SYSTEM
FOR
JOINT FORCE AIR COMPONENT COMMANDER
(JFACC)
COMBAT PLANNING

THESIS

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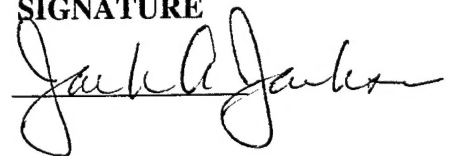
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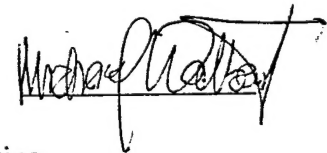
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A DECISION SUPPORT SYSTEM FOR
JOINT FORCE AIR COMPONENT COMMANDER (JFACC) COMBAT PLANNING

THESIS

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Air Force Institute of Technology
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Master of Science in Operations Research

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Table of Contents

	Page
Acknowledgments.....	ii
Table of Contents.....	iii
List of Figures.....	iv
List of Tables.....	vi
Abstract.....	vii
1. INTRODUCTION.....	1
1.1. PURPOSE AND BACKGROUND	1
1.2. PROBLEM STATEMENT.....	2
1.3. RESEARCH ISSUES	4
2. LITERATURE REVIEW.....	6
2.1. CONTINGENCY THEATER AUTOMATED PLANNING SYSTEM (CTAPS).....	6
2.2. THE ADVANCED PLANNING SYSTEM (APS)	7
2.3. JFACC PLANNING TOOL (JPT)	8
2.4. JFACC PROGRAM AT THE DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA).....	10
2.5. SUMMARY OF PRESENT JFACC PLANNING TOOLS.....	12
3. METHODOLOGY.....	13
3.1. THE 9AF AIR CAMPAIGN PROCESS	13
3.2. THE PRIORITIZED TARGET LIST AND THE MASTER AIR ATTACK PLAN (MAAP)	13
3.3. SERVICING THE TARGET LIST	14
3.4. FORCE APPLICATION AND STRIKE PACKAGES.....	16
3.5. AIR CAMPAIGN DATA TO CTAPS	17
3.6. ANALYSIS AND REPORTS.....	18
3.7. AREA OF THESIS APPLICATION	18
3.8. REQUIREMENTS	18
3.9. SOFTWARE SELECTION	20
3.10. APPLICATION DESIGN.....	20
3.11. DATA FIELDS.....	20
3.12. INITIAL DATA INPUT AND RELATIONSHIPS.....	21
3.13. THEATER AIR CAMPAIGN FORCE STRUCTURE AND CONSTRAINTS	22
3.14. ASSEMBLING STRIKE PACKAGES IN THE AIR CAMPAIGN PLAN.....	22
3.15. DECISION SUPPORT DISPLAYS	23
3.16. POST PLANNING ANALYSIS	24
4. RESULTS.....	26
4.1. SECURITY	26
4.2. THE DSS IN THE NGAT PLANNING PROCESS	27
4.3. RAPID DATA INPUT	27

4.4. SCHEDULED SORTIE ASSESSMENT	28
4.5. APPORTIONMENT AND JFACC GUIDANCE	29
4.6. VERIFICATION AND VALIDATION	31
5. CONCLUSIONS	32
5.1. CAPTURING THE MASTER AIR ATTACK PLAN.....	32
5.2. OPTIMIZATION AND DECISION ANALYSIS	33
5.3. RECOMMENDATIONS FOR FUTURE RESEARCH IN THE CURRENT DSS.....	34
5.4. SUMMARY	35
6. APPENDIX A: DSS USER'S MANUAL.....	37
7. OVERVIEW FOR PREVIOUS MS ACCESS USERS	40
7.1. COPY BLANK DATABASE AND RENAME.....	40
7.2. LOAD THE FORCE STRUCTURE.....	40
7.3. COPY DSS WITH THE FORCE STRUCTURE LOADED	40
7.4. ENTER STRIKE PACKAGES OR MISSIONS; ASSESS GOALS USING TOOLS	41
7.5. AT THE END OF THE ATO DAY PLANNING CYCLE, PROTECT COMPLETED FILE.....	41
8. STEP BY STEP TUTORIAL	43
8.1. CREATE A WORKING FILE	43
8.2. START MS ACCESS.	43
8.3. LOAD MISSION DATA	47
8.4. USING THE TOOLBAR.....	51
9. TOOLBAR BUTTONS.....	53
9.1. WHAT'S AVAILABLE?	53
9.2. WHAT'S FLYING?	55
9.3. WHAT'S FLYING VS WHAT'S AVAILABLE.....	57
9.4. TOTAL SORTIES PER UNIT.....	58
9.5. SUMMARY OF MISSION TYPE UTILIZATION.....	59
9.6. ALL SCHEDULED MISSIONS FOR ONE UNIT	61
9.7. ALL MISSIONS SCHEDULED, GROUPED BY PACKAGE	61
9.8. ALL MISSIONS SCHEDULED, GROUPED BY UNIT ID.....	61
9.9. AIR-TO-AIR REFUELING TRACK UTILIZATION EXPORT TO EXCEL	61
10. TRAINING	62
11. ALIBIS	62
12. BIBLIOGRAPHY	65
13. VITA.....	68

List of Figures

	Page
FIGURE 1 APS PACKAGE WORKSHEET (18)	8
FIGURE 2 JPT CONCEPT (18).....	9
FIGURE 3 JPT OUTPUT (18).....	10
FIGURE 4 MAAP/ATO DEVELOPMENT TIMELINE (18)	15
FIGURE 5 GUIDANCE, APPORTIONMENT, AND TARGETING (GAT) PROCESS	16
FIGURE 6 DATA FIELDS AND RELATIONSHIPS	21
FIGURE 7 PACKAGE DATA ENTRY FORM.....	23
FIGURE 8 MISSION TYPE SUMMARY	30

List of Tables

	Page
TABLE 1 CURRENT PLANNING TOOLS	12

Abstract

This system allows assessment of the Master Air Attack Plan (MAAP) during construction and at completion. The system functions around a relational database management system providing a decision support tool for the Guidance, Apportionment, & Targeting (GAT) cell of Central Command's JFACC Combat Plans. A Microsoft Access application is programmed to provide PC-based, real-time evaluation of air campaign goals and constraints.

The decision support system was validated in February 1997 by the CENTAF combat plans staff at Blue Flag 97-1. The software and user's manual are maintained at HQ ACC/XP-Studies and Analysis Squadron.

1. Introduction

1.1. *Purpose and Background*

The purpose of this thesis is to use operational science to aid in the objective-to-strategy-to-task analysis of a Joint Force Air Component Commander (JFACC) combat plans squadron.

The JFACC, as a doctrinal concept, is relatively new to the Department of Defense. The concept emerged in WWII but never existed in Korea or Vietnam. During the Vietnam war, the Route Pack system divided air combat capability into 7 geographic areas. Among the different services, commanders operated autonomously and maintained control of their assets. Air Force assets were further divided into areas of responsibility for Seventh Air Force, Thirteenth Air Force, and Strategic Air Command. The commander's decision process was less complex than today's JFACC concept.

In Operation Desert Storm, Central Command (CENTCOM) closely followed prewar doctrine resulting in General Schwarzkopf designating General Horner the JFACC for the Southwest Asia (SWA) theater (1:5). General Horner's air campaign worked very well and service concerns with the JFACC concept are clearer. Military leaders are reluctant to give control of assets to another service but did so under Joint Force Commander (JFC) guidance. To fulfill military objectives, service leaders planned autonomous and joint missions where air assets were controlled by a USAF JFACC.

Even so, two years later during both Tandem Thrust '93 and Ocean Venture '93, many Navy personnel on the JFACC (afloat) staff, had never heard of the JFACC concept (2:9).

With some minor exceptions, today's JFACC has operational control over all assigned and attached conventional combat aircraft operating in the theater. Also, the JFACC is normally designated the Airspace Control Authority (ACA) and the Area Air Defense Commander (AADC) (3:II-3). As such, JFACC responsibilities may increase to control all combat assets operating in airspace above the theater. Air operations may include coordinating Army deep-strike helicopter missions, Army tactical missiles, and Navy Tomahawk cruise missiles with fixed wing assets from USAF, Navy, USMC, and allied nations.

1.2. Problem Statement

The JFACC concept forces an extremely complex centralized planning process. Centralized planning must coordinate geographically separated and diverse weapon systems from all services and from allied nations. The planners must place these weapon systems in an air campaign plan that synchronizes aerospace, land, and sea efforts. Under the JFACC centralized planning concept, the command and control structure has not been responsive enough for rapid execution. This forces the development of new and innovative tools to aid planners in sequencing air operations to meet theater objectives (4:65). To move from National Command Authority (NCA) directives, to air campaign plan, to Air Tasking Order (ATO), involves many complex decisions.

The JFACC provides the linkage between strategic objectives and the application of air combat power (4:60). Within a theater, NCA objectives are implemented by the theater Commander-In-Chief (CINC) or JFC. The JFC designates a JFACC who forms a joint staff to manage theater air assets (3:II-7). The end product of the JFACC staff is an ATO assigning all aircraft to missions and specifically aircraft and weapons to targets.

The combat plans flight translates NCA and JFC guidance into JFACC guidance for the air campaign:

- Phased Air Objectives.
- Prioritized & Sequenced Air Tasks.
- Air Scheme of Maneuver.

The ATO reflects course of action analysis and decisions in force selection, mission integration, and execution/engagement (5:13-16).

Several LP models exist to assign aircraft and weapons to targets within budget and/or force constraints (6:1). Most require a large data base and extensive computer time to come to a solution. Models are not readily available to quickly assess strategy-to-task decisions. This may be caused by the changing nature of the JFACC role and revolutionary increases in technology and information available to the JFACC. The USAF recognized this and has an ongoing effort to bring new technology to the planning staff. The Defense Advanced Research Projects Agency (DARPA) under their JFACC program, seeks to provide a foundation for the "JFACC After Next" (5:5). This is a five year plan to develop, integrate, and demonstrate technologies which enable revolutionary air campaign planning processes. Since 1993, HQ USAF/XO (Checkmate) has been

building the JFACC Planning Tool (JPT). Within JPT, the Intelligence Surveillance Reconnaissance Planner will be used to optimize the Master Attack Plan (7:1, 9-11). JPT is near completion but as yet, not fielded (8). The need exists today to bring modern operational science techniques to the JFACC staff to increase speed and efficiency in combat plans analysis.

1.3. Research Issues

Within the continental United States, the Eighth Air Force, Ninth Air Force, and Twelfth Air Force commanders are normally tasked as JFACCs. Similar arrangements exist in the European and Pacific theaters. Each of these commanders is actively involved in the present day mission of supporting NCA objectives. Some of these commanders are planning *and executing* combat missions daily against nations hostile to US interests. The JFACC staff will testify that their present system works, and works well. The staff will also confirm present duties are a full time job (9). Any change to the JFACC planning process represents risk to those presently employed in planning and needs to be sold to the JFACC planners.

A JFACC planning staff is composed largely of experienced field-grade fighter aircrews. Many are experts in air combat weapon system employment. Any attempt to aid planners needs to be accompanied by a thorough knowledge of weapon system employment and the ergonomics of air campaign planning. The author brings these qualities to the research effort and is able to identify those areas where operations

research tools may be applied. Furthermore, this research will be accomplished with the Ninth Air Force staff, currently tasked to defend US interests in Southwest Asia.

A major function of the Combat Plans squadron is creating the Master Air Attack Plan (MAAP). The MAAP is prepared by the Guidance, Apportionment, and Targeting (GAT) cell within combat plans. Any assessment of the MAAP requires capturing applicable specific targeting data to compare against constraints or goals. Assigning combat assets to a prioritized target list is the dominating task of preparing the MAAP (11:17). This assignment process requires the most effort of all combat plans tasks because this process is bound by many constraints and goals. Some goals are well defined, others goals are fluid, subjective tradeoffs internalized by the senior combat tactician (17:1). The goal of the thesis is to bring an easily understood representation to a JFACC staff tactician giving a clear picture of selected goals and constraints.

Key questions in the thesis project :

- Can a decision support system be created to capture the MAAP details?
- Can combat plans officers use the system to capture the data within the current planning process?
- Can the system provide intermediate analysis with a partially completed plan?
- Can the system be created using available software and hardware?
- Can the system present assessment criteria clearer? more expeditiously?
- Can the system provide new areas for analysis?
- Can system results be verified and validated?

2. Literature Review

Since Desert Storm, the need for tools to connect campaign plans to campaign objectives has been evident to many analysts. Research is in progress, but only the Contingency Theater Automated Planning System (CTAPS) and the JFACC Planning Tool (JPT) exist in today's Air Operation Center (AOC) (17:2). The following paragraphs will review current assessment systems available to the JFACC staff and recent research proposals.

2.1. Contingency Theater Automated Planning System (CTAPS)

Through the 1970's, the ATO was built entirely by pencil and paper, and then transmitted via a USAF message distribution system. Later, a stand alone system was fielded to allow transmission of the ATO directly to flying units from the AOC. This capability has evolved with other systems to become CTAPS. CTAPS merges computer workstations, relational databases, and networked communication to construct a Theater Battle Management (TBM) system for air forces. Ground and naval forces execute missions under similar TBM systems. Specific CTAPS capabilities are (18:Overview) :

- Organize intelligence information.
- Build the ATO.
- Disseminate the ATO.
- Monitor and control execution of the ATO.
- Track progress of the ATO.

2.2. The Advanced Planning System (APS)

One of systems assimilated into CTAPS is the Advanced Planning System. This system is designed for use by target planners on the JFACC staff. The primary purpose of APS is to match combat resources to a target list. The system is not user friendly. Any user must complete initial formal training at the USAF Air Ground Operations School (AGOS). Required proficiency also demands periodic hands-on training at a CTAPS terminal (18: APS Overview). The Force Package Worksheet (Figure 1) is the APS function aimed at planners assigning strike packages against targets. This worksheet is very complex. CENTAF maintains a rigorous proficiency training program for all APS users qualified to operate the Force Package Worksheet. Qualified operators are employed full time just insuring accurate data is input to the CTAPS system through the Force Package Worksheet. For a single strike package, a qualified operator spends several minutes diligently entering data through this worksheet. Combat planners are not qualified operators. Even if planners were qualified operators, the data entry process is too slow to provide timely analysis. It is not used at CENTAF in the targeting process (13).

Force Package Worksheet																
Exit													More		Return	
PKG ID: S		DESCRIPTION: B-TAC/D														
REF POINT TYPE: RENDEZVOUS		REF TIME: 12070800/12070815		LATITUDE: 300759N		LONGITUDE: 0481829E										
PKG DEFINITION/SELECTION <F17>				PLAN PKG REFUELING <F18>				REQUEST EC SUPPORT <F19>				SHOW PKG FLOW <F20>				
HIGHLIGHT PKG TARGETS ON MAP					UNHIGHLIGHT PKG TARGETS ON MAP					DISPLAY PKG ROUTES ON MAP						
TARGET INFORMATION																
#MSNS	TGT #	RQST #	MSN	TYPE	PRI	OBJECTIVE	TOT/TFT	TARGET NAME	BE	DMPI NAME	TGT TYPE	LAT	LONG			
0	100101	3V301	CAS	1F	NEUTRALIZE	ARMOR-CP4	T444-08450	ARMOR	ARMOR	ARMOR	ARMOR	290500.0N	0475900.0E			
0	100201	3V311	CAS	1E	NEUTRALIZE	ARMOR-CP3	T444-08451	ARMOR	ARMOR	ARMOR	ARMOR	290700.0N	0474700.0E			
0	100401	3V371	CAS	2B	NEUTRALIZE	UTK-JAAT ZULU	T444-08454	ARMOR	ARMOR	ARMOR	ARMOR	291200.0N	0474000.0E			
0	100501	3V372	CAS	2B	NEUTRALIZE	UTK-EA VICTOR	T444-08455	ARMOR	ARMOR	ARMOR	ARMOR	292300.0N	0474100.0E			
0	100601	3V381	CAS	1G	NEUTRALIZE	ARMOR-CP3	T444-08456	ARMOR	ARMOR	ARMOR	ARMOR	290700.0N	0474700.0E			
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> The Force Package Worksheet is one of the most complex planning windows in APS. </div>																
APS REF #	MSN ID	PKG ID	MSN TYPE	MSN PRI	MSN LOC	MIS SCHE	CALL	CALLWORD	#	IFF/SIF	SUPPORT	AAR	EC	ESC		
8347	2101	KS	INT	1N	200301	12070830	GANGWAY	02	01/2101/2100	N	N	P				
8348	2103	KS	INT	1N	200302	12070830	GANGWAY	03	01/2103/2102	N	N	N				
8350	363	KS	DCA	1N	200303	12070830/12070845	NLT DESA 49FW-2 2 F15 BEST	THORNY	37	01/3637/3637	N	N	N			
8351	3641	KS	DCA	1N	200303	12070830/12070845	NLT DESA 49FW-2 2 F15 BEST	THORNY	42	01/3641/3641	N	N	N			
8523	1161	KS	ESC	1N	200301	12070830/12070845	NLT OETB 43ECS 2 EF111 BEST	QTRON	61	01/1161/1160	N	N	N			
MISSION PLANNING WORK AREA																
APS REF #	MSN ID	MSN TYPE	MSN LOCATION	MSN SCHEDULE	BASE TYPE	UNIT	NUM	TYPE	PRI	SEC	CALLWORD	CALL	IFF/SIF			
8523	1161	ESC	200301		OETB	43ECS	2	EF111	BEST		QTRON	61	01/1161/1160			
<input type="checkbox"/> Override Availability <input type="checkbox"/> Override Weaponing MODIFY <F7> CLEAR <F14> AMPN																
AVAILABLE RESOURCES																
BASE UNIT	TYPE	NUM	TOTAL	MSN	NUM	NUM										
A/C	A/C	SORTIES	CAT	ALLOC	TASKED											
OIZE HMA367	AH1W	12	20	OIR	0	0										
FARP GAHRT	AH54	20	47	OIR	0	0										
DEJD 21AS	C130	16	150	OIR	18	0										
OIZE HMA366	CH46	24	56	OIR	56	0										
CONFIGURATION OPTIONS																
TYPE	CONFIG	PRIMARY														
A/C	ID	COMP	RANGE													
A10	B10	SUU30	250													
	B11	SUU30	250													
	B12	MK36	250													
	B13	CBU87	250													
WEAPONING OPTIONS																
NUM	TYPE	CONFIG														
TGT #	A/C	A/C	ID	Pd	OBJECTIVE											

Figure 1 APS Package Worksheet (18)

2.3. JFACC Planning Tool (JPT)

JPT is a decision support system designed for AOC planning by quickly assisting in developing campaign plans. JPT will be initially fielded with a stand-alone capability to aid in force application. Future developments incorporate capabilities in aerospace control, force enhancement, and force support (Figure 2). Eventually, JPT will enjoy full integration with CTAPS Theater Battle Management Software Core System (TBMCS) Version 1.0 software. As JPT reaches projected maturity, JFACC planning will become

more flexible and efficient (17: 38). The remainder of this discussion focuses on current JPT operation and capabilities.

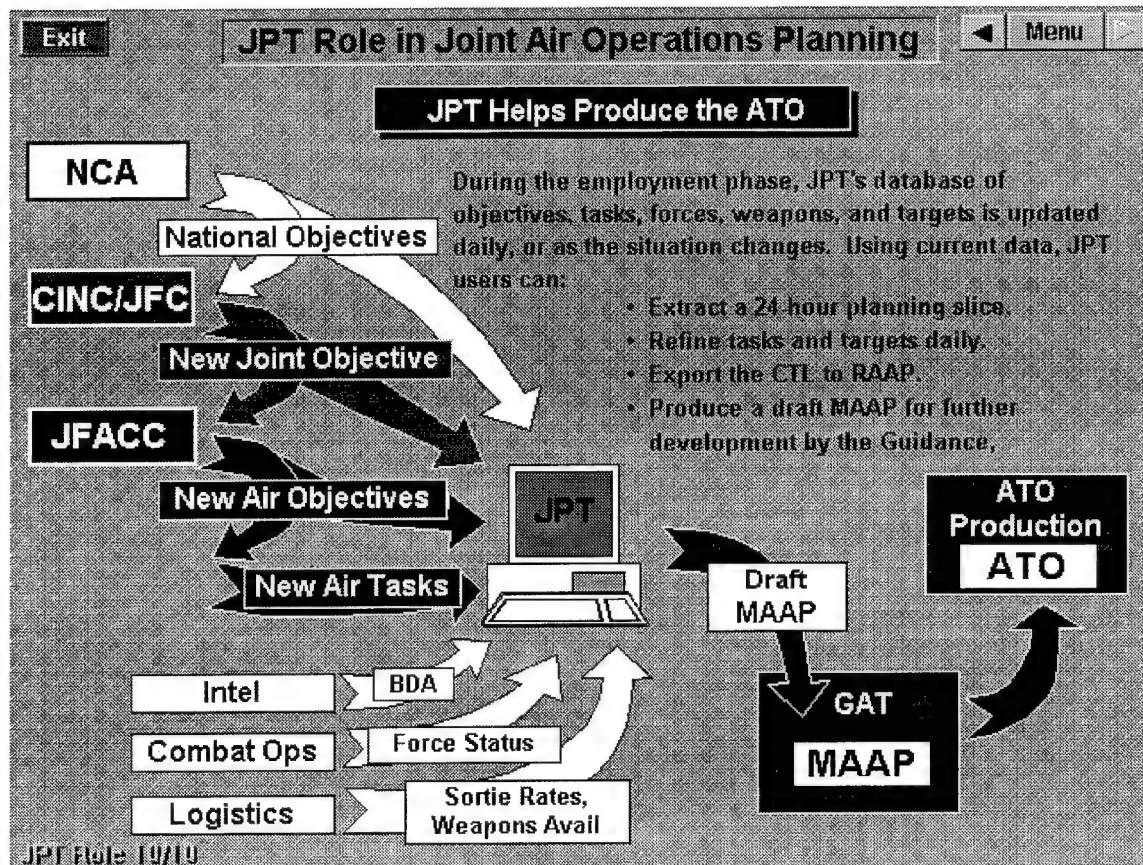


Figure 2 JPT Concept (18)

The core of JPT is the Conventional Targeting Effectiveness Model (CTEM). CTEM is a linear program used by headquarters analysts. In essence, CTEM attempts to optimize assignment of aircraft and weapons to targets based on known destructive capabilities and target prioritization weights input by the user (6:34). The JPT user captures the JFACC guidance and quantifies this for input to JPT. Currently, the crux of

the JFACC guidance used by JPT is the prioritized Target Nomination List (TNL) produced daily in JFACC Combat Plans. JPT also contains theater force structure limitations and weapons limitations, in addition to munitions effectiveness data.

While bringing a very powerful analytical tool to the JFACC staff, the JPT output, in its current form, is difficult for staff members to interpret (8, 12, 13, 14, 19). The bulk of the output displays single aircraft, armed with a specific weapon, assigned to a target from the TNL (Figure 3). While this brings insight to identify some limitations, the display is too difficult to transform into strike packages for force application (13, 14, 19).

CTEM Results – Master Attack Plan

Current: Results in file '/cm/data/IPTSystem/brdg.pln' # of targets: 3

Entire List Select / Deselect Items Manipulate Selected Items

Description	Lat	Lon	Msn #	Pltfm #	Wpn	PD
LD	252814N	842055E	OCA 1	F-15E	2	GBU-xx 0.80
HWY BR OV CANAL SW	202937N	874430E	INT 2	F-16C	2	GBU-xx 0.80
SES HWY BR W	210245N	861423E	INT 2	F-15E	2	GBU-xx 0.80

Choose Target BE/ID # of Target: Day: Edit Chosen Target

Figure 3 JPT Output (18)

2.4. JFACC Program at the Defense Advanced Research Projects Agency (DARPA)

In May 1996, DARPA began soliciting papers for a “JFACC After Next” project. Proposals were submitted and awards announced in December 1996. The goal of the

JFACC program is to develop, integrate, and demonstrate technologies which enable revolutionary air campaign planning processes. The end result will be a significant enhancement of the JFACC's ability to plan and execute an air campaign. Some specific objectives are (5:5) :

- Transform planning from reactive to near-real-time predictive planning.
- Enable rapid evaluation of alternatives.
- Facilitate less human-intensive planning processes.
- Facilitate planning and execution tailored to theater needs.
- Provide a system supporting a range of operational concepts.

The conceptualized "JFACC After Next" significantly reengineers the current planning process. Within the concept, plans are developed by collaborative planning teams. These teams may be at the same location or work together over a distributed network. The concept is made possible through technology developments occurring within the JFACC program. The dominant premise is that future JFACC planning and operations must be flexible enough to support rapidly changing conflicts from Major Regional Conflicts (MRC) to Operations Other Than War (OOTW) (5:8).

The JFACC program outlines specific goals throughout the development process. For example, by the close of FY1998, campaign level systems analysis will identify the most effective targets for a single day's ATO within 1 hour. Program goals continue through the year 2000. There is no forecast for fielding any DARPA developments in the JFACC program (6:28).

2.5. Summary of Present JFACC Planning Tools

What is available today for the vanilla combat plans staff officer? Table II-1 summarizes the tools and capabilities of systems in an AOC.

Table 1 Current Planning Tools

	Fielded	Useable during GAT planning	Assessment after planning	Operated by GAT planners	Used today if we go to war
JPT (17)	July 1997	Yes	Projected	Projected capability with formal training	NO
CTAPS & APS	Yes (18)	No (13)	Possible capability hours after planning (18)	No, extensive training and experience required (18)	NO
DARPA Program	No 2005?	Yes	Projected	Projected	NO

3. Methodology

Given the basic knowledge of the USAF mission in a joint force, the thesis research began in three areas:

- a. Learn the ergonomics of the MAAP building process.
- b. Create a system to capture MAAP data.
- c. Apply operations research techniques to bring useful analysis to the decision maker.

3.1. *The 9AF Air Campaign Process*

This investigation consisted of initial telephonic interviews followed by a one day meeting at 9AF HQ, Shaw AFB, SC. Additional telephonic interviews continued for approximately 10 weeks of application development followed by a 1 week trip to exercise the prototype version of the decision support system.

3.2. *The Prioritized Target List and the Master Air Attack Plan (MAAP)*

As discussed earlier, one of the directives generated by the JFACC strategy is a prioritized target list. Servicing of this list is a major function of the combat plans squadron in developing a MAAP (11:17). Each of the diverse assets available to service the targets retain different limitations and bring different strengths. Another fact is the target list cannot be assigned sequentially beginning with target 1. Regardless of decision analysis support, the JFACC guidance, target list, combat assets, tactics, weather, enemy

threats, and other factors must be considered by a combat planning professional before a plan is developed to assign combat assets to targets (10). The need for an expert air campaign tactician is evident in all the research.

3.3. *Servicing the Target List*

A basic process in combat plans is using the prioritized target list with JFACC guidance to assemble forces into a Master Air Attack Plan and an Air Tasking Order (Figure III-I). This begins when the night-shift Chief, Guidance, Apportionment, and Targeting Branch (NGAT Chief) reports for duty in the late afternoon. The target list is available and other information is gathered concerning weather, intelligence and current force structure. Within a few hours, the NGAT Chief assembles a planning team with representatives from all participating US and allied forces (11:12). The NGAT Chief is typically seated at a head table with a map of the theater. Around the head table are intelligence and operations professionals providing inputs to the NGAT Chief (Figure III-II). Asset availability, specific target aim points (DMPI), and other data is recorded and tracked via handwritten forms and document folders. Some of these forms are passed to specific force managers seated at various tables throughout the room. The process crudely resembles a production line:

- a. The head table assigns destructive assets to service a target and specific DMPIs.
- b. Documents or folders are passed to other tables to assign/confirm:
 - i. Weapons allocation

- ii. Escort or Counter Air assets
 - iii. SEAD or electronic warfare assets
 - iv. Reconnaissance assets
 - v. Air-to-Air Refueling assets
 - vi. Special requirements
- c. Information is added to the forms and folders at each table and then returned to the head table.
 - d. The NGAT Chief reviews appropriate forms and initials the forms for final approval.
 - e. The appropriate forms are passed to 9AF ATO Development Division personnel for input into the APS/CTAPS system.

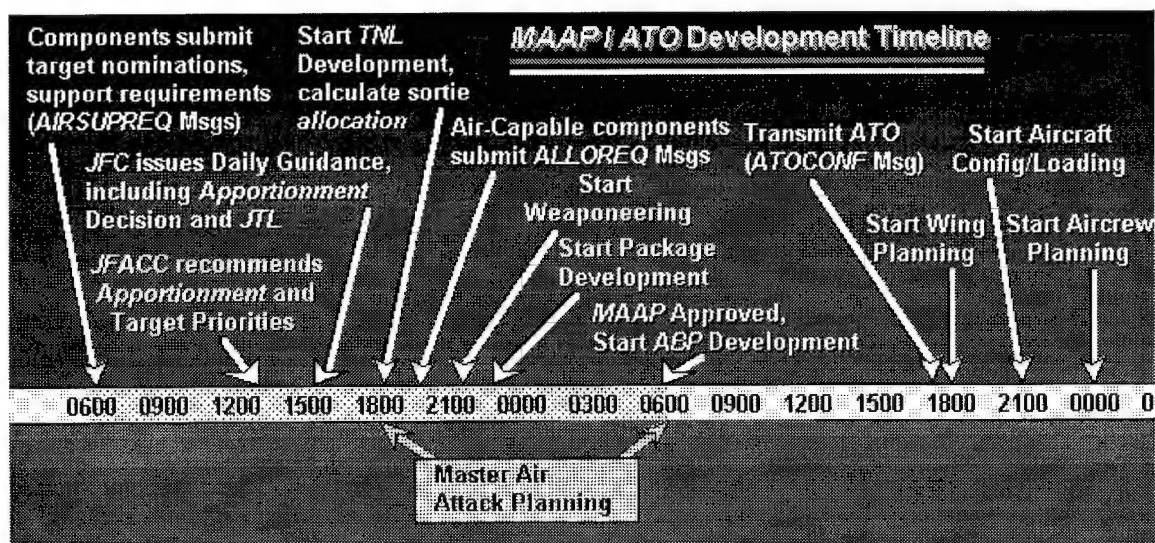


Figure 4 MAAP/ATO Development Timeline (18)

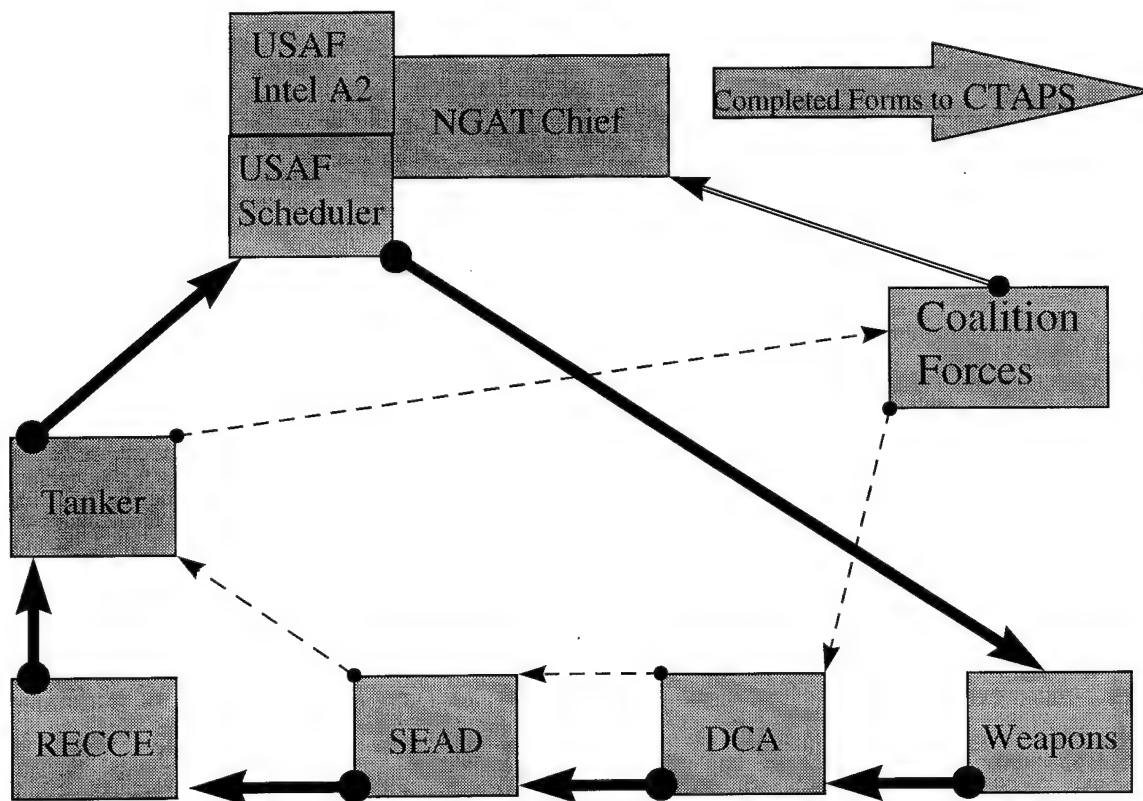


Figure 5 Guidance, Apportionment, and Targeting (GAT) Process

3.4. Force Application and Strike Packages

The most labor intensive portion of the MAAP building process is the assignment of different combat assets into packages exploiting the unique capabilities of the weapon systems in the package (12). The professional air combat tactician attempts to maximize enemy destruction but must track numerous availability constraints. Among the constraints are:

- a. Aircraft utilization (UTE) rate for each unit in the force.
- b. Maximum number of aircraft available from each unit.
- c. Times returning aircraft are available for assignment to a new package/target.
- d. Transit times to targets for aircraft assigned to geographically separated bases.

The NGAT Chief uses a standard form to assign assets to targets in a package.

Other forms are grouped with this form into a folder for each strike package in an ATO.

These package folders comprise the only complete record of information for each package. In addition, various handwritten tables are constantly updated to assess availability of assets.

3.5. *Air Campaign Data to CTAPS*

When the package folders are complete and receive final approval from the GAT Chief, the folders are passed to 9AF ATO Development Division for input to CTAPS. The APS portion of CTAPS contains some algorithms to compare the value of some parameters against known constraints, some are listed in III.1.3 above. Typically, an APS algorithm is a rudimentary calculation such as a fuel flow, airspeed, and distance computation to determine feasibility of a scheduled mission. APS may identify a potential conflict 2-6 hours after the planning process is completed (13). The NGAT Chief and his staff have probably completed their shift and are unavailable. The dayshift GAT cell has advanced to the next day in the planning cycle. An APS conflict is usually unwarranted, and involves retrieving the respective package folder and confirming validity of the missions with the GAT staff or an available subject matter expert (12).

3.6. Analysis and Reports

Normally, reports are prepared showing basic allocation of assets/sorties to meet JFACC objectives. Reports are also completed showing the portion of assets assigned to particular USAF missions. These reports are generated by pencil-and-paper tallies of the different handwritten forms maintained by the staff. Any further analysis of the ATO by the planners is done by retrieving data from the forms or folders (13).

3.7. Area of Thesis Application

A strong area of interest during research was the decision process from objective to strategy to task. Could a decision support system aid decision makers in any part of the campaign plan process? As discussed in III.1.2, almost all material used to support tasking decisions are handwritten forms. The planning staff has no readily accessible electronic tools to use in the decision making process. When the tasking decision is complete, in the form of a MAAP, the planning staff has no electronic record of the results (13). Although many areas are ripe for some operations research applications, the thesis quickly centered on the process assigning aircraft to strike packages (III.1.3). This process required the most overhead in tracking combat asset parameters.

3.8. Requirements

The most experienced planners met to create requirements. To accomplish any analysis, the MAAP specifics must be captured electronically. Due to the speed and intensity of the planning process, the staff must enter and analyze the data quickly. Regardless of the value of the analysis results, members all agreed there is no time to

painstakingly type every detail into a database. Post-planning analysis presently involves rifling through forms and papers. Post-planning requirements are vague lacking experimentation with a prototype. The project began with the following requirements (13) :

- a. Create a decision support system allowing constant assessment of combat force status. As strike packages are assembled and scheduled:
 - i) Allow rapid input of applicable data creating a source to assess the current plan.
 - ii) Assess sorties scheduled against planned UTE rate by specific unit.
 - iii) Assess number and type of aircraft flying at any time by specific unit.
 - iv) Assess number and type of aircraft available for a planned Time on Target (TOT).
 - v) Design input of an aircraft range variable to allow accurate assessment of strike aircraft tasked for missions that deviate from average flight times.
- b. Design for a personal computer (PC) user with minimal computer literacy.
- c. Design system data entry to mirror the existing handwritten data entry process.
- d. Design an electronic form to replace the existing paper form.
- e. Use existing PCs and existing software.
- f. When strike packages are completed for a single day's ATO, allow easy access to the plan for assessment and reporting purposes.

3.9. Software Selection

Readily available to any JFACC staff is the Microsoft (MS) Office software suite. The suite exists on almost all staff computers, both desktop and laptop. In austere conditions with limited assets, a copy of MS Office can be found. Within MS Office, MS Access (20) was selected to capture MAAP data and perform analysis. The core of MS Access is a relational Database Management System (DBMS) (15:52).

3.10. Application Design

With MS Access as the application, the appropriate data was selected for input to the DBMS. The data was organized into tables with relationships and an electronic form was designed to match the current form. Queries and functions were written to analyze and structure the data for decision analysis in accordance with the requirements. Given the recently acquired capability to archive the strike plan, new areas were investigated for useful analysis previously not possible.

3.11. Data Fields

The initial data fields chosen were the complete data fields used in the current handwritten forms. A range field was added to the electronic form to meet the requirement in 3.8.a (v). The data was organized for input to tables with the appropriate fields and relationships (Figure 6).

tblTgtNumbers tables exist primarily to ergonomically accelerate data input, but also provide error reduction when rapidly entering data.

3.13. Theater Air Campaign Force Structure and Constraints

Next, the JFACC staff enters the available combat force. The critical fields are number and type aircraft and the UTE rate. The number of aircraft multiplied by the UTE rate is the upper limit of allowed sorties per unit per day. The *Combat Units* table is used for lookup expediting input of strike package data. The *Combat Unit ID* field is not strictly limited (by DBMS referential integrity) to the types entered in this table.

3.14. Assembling Strike Packages in the Air Campaign Plan

With the force structure definitions and constraints loaded, the user begins input of the forces required for each strike package (Figure 7). A visual basic routine completes the *Aircraft Type* field when the *Unit ID* field is selected, reducing errors and speeding data entry. The lookup functions are also designed to index the associated table as each character is entered. For example, the displayed fields for entry are reduced by entering the first letter of the field. This further simplifies data entry for an ergonomically sound approach to incorporate the system into the existing process.

The original electronic form contained all fields found on the current paper forms. This requirement changed when the system was used in support of CENTAF Quickfrag training (14). The training brought CENTAF staff members together to exercise the ATO building process. The requirements changed as follows:

- a. The electronic form would not be used to replace the current forms.

Variations in the use of the current paper form make the printed electronic form unmanageable as a replacement for the current form.

- b. Not all fields in the current form should be included in the decision support system. Some fields requiring the input most time yield the least value in potential analysis. It is not cost effective to enter all fields from the paper form. The *PriSCL*, *SecSCL*, *MSNID*, and *AMPN* fields were eliminated from the electronic form.

Available? Flying? Fly Vs Available Series/Unit MsnTypeCount Msn: 1Unit Msn: ByPkg AAR ToExcel Msn: ByUnit

Package Data Entry 4

Package Form

Package ID: APC PrevPkg NextPkg Print Form

YOU MUST ENTER "PACKAGE ID" BEFORE ENTERING MISSIONS

MSN Types	TgtNumber	TOT	Unit ID	NumAC	TypeAC	AAR Trak	Range	Con
INT	68	12:00	25FS	4	P26	Tangerin	Med	
INT	69	12:00	25FS	4	P26	Tangerin	Med	
INT	70	12:00	3BSQN	2	B1	Plum	Med	
ESC		12:00	10FS	4	F15C	Tangerin	Med	
EW	70	12:00	1FS	2	EF111	Plum	Med	

Notes to ATD Development: W C E AWACS (Circle One)

Coord: WPNS / SEAD / DCA / RECCE / TNKR / SCHED / GAT Chief /

Record: 15 of 51

Figure 7 Package Data Entry Form

3.15. Decision Support Displays

Data queries were written to assess decision parameters. The time critical queries are executed by toolbar buttons. While entering data, the user may at anytime assess

available assets with a point-and-click action on the toolbar buttons. The assessment appears in an easily distinguishable tabular form (User's Manual, Appendix A). The program returns automatically to the data entry mode when the assessment is complete. The queries display the following decision factors:

- a. Number of sorties scheduled for each unit against the unit's UTE rate constraint.
- b. At a user-defined time of interest, show number of aircraft in each unit executing a mission or in service. This parameter is necessary to insure a unit with 15 aircraft isn't scheduled to fly 16 aircraft at the same time, even though the unit is allowed by UTE to fly 30 sorties per day.
- c. At a user-defined time of interest, show previously scheduled aircraft now ready for new tasking. The display shows flights in each unit which have become available within 2 hours of the time of interest.
- d. At a user-defined time of interest, show aircraft availability and the number of aircraft in service. At the time of interest for each unit, the display shows total aircraft available for tasking, the total number of aircraft in service, and the UTE constraint. Among units with available aircraft, this display allows the user to assess which units are most capable of taking a new mission.

3.16. Post Planning Analysis

When the planning process is complete, the strike plan exists for additional analysis. Reports are available showing:

- a. Summary of mission type allocation.
- b. Total sorties for each unit against UTE constraint.
- c. Sorties and mission flow for each unit.
- d. Summary of all strike packages.

4. Results

The author worked with CENTAF Combat Plans during two combat planning exercises serving in the NGAT cell. In each exercise, a mock CENTAF force was committed to defending the Southwest Asia (SWA) Area of Responsibility (AOR). An alpha version of the decision support system was used by the CENTAF staff at Shaw AFB, SC while building the MAAP for a 24 hour ATO at the CENTAF Quick Frag exercise in December 1996. The final version was used by CENTAF Combat Plans in February 1997 at Blue Flag 97-1, Hurlburt Field, FL. Here, the application was installed on a CENTAF PC and used by the NGAT cell during the production of four 24 hour ATOs. The results in this chapter are from personal conversations with CENTAF combat planning professionals assembled at the Blue Flag exercise.

4.1. Security

This thesis document is unclassified. All force structures used in the exercises held a security classification. The PCs used by the GAT cell are certified to hold classified information. None of the illustrations in this document depict data from the exercises.

The complete file containing an entire day's strike packages compresses easily on one 3 ½ inch floppy disk. A disk containing a complete MAAP is of immeasurable value to any potential enemy. Use of this support system requires the strictest COMSEC

compliance. A security evaluation should be requested before adopting this system in the NGAT cell production process.

4.2. The DSS in the NGAT Planning Process

The decision support system is used as essentially an additional station in the strike package production line discussed in III.1.2. The NGAT chief and the DSS user work constantly together as decisions are made. Strike package data is entered at a pace consistent with NGAT planning. Planners use the constant assessment capability in the decision system to assign combat assets to the prioritized target list.

4.3. Rapid Data Input

With the initial version used at the Quick Frag exercise, strike package data entry did not always keep pace with the normal planning process. At times, the PC user was busy entering previously planned mission data when a force assessment was required (14). The final version included ergonomic improvements such as reduction of input fields and improved use of lookup functions to speed data entry.

At Blue Flag 97-1, the user easily kept pace with the decision process. Three different DSS users described the system as user friendly. The user worked in close proximity to the NGAT chief. As USAF strike assets were assembled, data was immediately entered. Coalition countries assembled forces and this data was entered also. The NGAT Chief designated the DSS user as the last stop before final approval. Hence, when the NGAT Chief gave final approval, and passed the forms to CTAPS

operators, all data was captured by the DSS. Previously, the NGAT cell had no accurate record of MAAP data for analysis (19).

4.4. *Scheduled Sortie Assessment*

During the MAAP building process, the DSS user occasionally commanded a sortie utilization assessment. In these instances, the display normally confirmed areas of strong and weak utilization. Once, the display discovered under utilization of an asset. This asset was scheduled differently in the next planning cycle.

Utilization of specialized weapon systems, such as Suppression of Enemy Air Defense (SEAD) assets, is maintained by augmentee experts and not normally tracked at the NGAT head table. During the final planning cycle, the DSS display revealed the over tasking of a SEAD asset. An investigation began and the staff discovered an error in an augmentee's utilization formula. This discovery had a significant impact in concluding the planning process. Without the DSS, this error would go unnoticed until hours later when a CTAPS entry forced an over-utilization message. To correct this type error, the GAT cell must analyze alternatives and provide a solution before transmitting the ATO. A considerable effort may be required to reacquaint a GAT tactician to yesterday's planning factors. The DSS precluded this type of error.

However, should a similar error arise, yesterday's mission summaries, produced by the DSS, bring quick insight to planning factors. Prior to the DSS, the only way to recapture yesterday's plan was to retrieve the applicable handwritten forms. There is no summary information maintained in the handwritten forms. Any summary analysis would require hand calculations from data written on the forms.

4.5. *Apportionment and JFACC Guidance*

An apportionment objective is normally included daily in the JFACC guidance. Air apportionment allows the Joint Force Commander to ensure the weight of the joint air campaign is consistent with campaign phases and objectives (3:IV-7). At Blue Flag 97-1, the NGAT cell periodically used the DSS to produce a summary of asset utilization by mission type (Figure 8). This enabled the staff to assess their compliance with JFACC apportionment before completing the MAAP. Paper forms are constantly passed throughout the planning cycle, so each printed copy is coded with a date/time field so most recent copies can be distinguished among the large volume of paper forms. Also, retained copies are used to monitor progress toward an apportionment goal.

Prior to using the DSS, planners assembled handwritten tally sheets and attempted to summarize apportionment using pencil and paper (19). Diligent effort produced an apportionment summary but the factual accuracy was never known.

At completion of the MAAP planning cycle, in the time required to print two pages, the DSS user produced a final summary providing accurate measures of apportionment. These measures were used for the daily MAAP approval briefing to the JFACC.

Mission Types Report

MSN Types		# A/C
<u>AI</u>	Sum	40
	Percent	12.58%
<u>DCA</u>	Sum	38
	Percent	11.95%
<u>ESC</u>	Sum	56
	Percent	17.61%
<u>EW</u>	Sum	27
	Percent	8.49%
<u>INT</u>	Sum	97
	Percent	30.50%
<u>OCA</u>	Sum	40
	Percent	12.58%
<u>SA</u>	Sum	5
	Percent	1.57%
<u>SEAD</u>	Sum	7
	Percent	2.20%
<u>WW</u>	Sum	8
	Percent	2.52%
Total Sorties		318

11-Mar-97 22:53

Page 1 of 1

Figure 8 Mission Type Summary

A highly experienced USAF combat planner, holding the rank of Colonel, served as the senior member of the night combat plans staff at Blue Flag 97-1. As the CENTAF Assistant Chief, Plans and Operations, he considers the DSS an impressive, very valuable aid providing great summary analysis (19). The DSS brings a good summary of all strike packages and presents the package flow, each of which was unavailable previously. The summary allows staff members to consider re-packaging assets to more closely comply with JFACC guidance. Most importantly, the DSS provides the ability to compare accurate measures of merit against JFACC guidance (19).

4.6. Verification and Validation

During each exercise, verification was accomplished by comparing DSS output to identical calculations from handwritten forms. In each case, the DSS output was accurate. Validation is successful as the DSS was incorporated into the existing wartime process at Blue Flag 97-1.

5. Conclusions

Using hardware and software available to staff officers, operations research techniques can be used to aid decision makers in the JFACC combat planning process. The details of the MAAP must be placed in electronic records before analysis is possible. Process ergonomics will require careful consideration in any effort to bring analysis products to the planners.

5.1. *Capturing the Master Air Attack Plan*

If Desert Storm is picked as an example, a Guidance, Apportionment, and Targeting (GAT) cell would assign weapons and targets to approximately 2000 sorties. They would accomplish this in 6-8 hours using a theater map, intelligence, JFACC guidance, and a list of aircraft and weapon limitations. Only the finest military professionals can take 6 hours and assign 2000 aircraft-to-weapons-to-targets so that the enemy feels compelled to surrender. It suffices to say, these people work at a frantic pace, making decisions and shuffling a horde of paper forms toward a CTAPS operator.

To bring the MAAP into an electronic record for analysis, someone must exist to input the data. Theoretically, anyone capable of using a keyboard could type data from paper forms. However, the process is not designed around entering data for the GAT cell's computer. Most of the paper forms are quickly completed in pencil to keep pace with the process. Four or more individual handwriting styles are describing acronyms peculiar to anyone outside the combat air forces. Interpreting the forms is sometimes difficult for the most seasoned professional. So, any attempt to read these documents and

input data will probably be done by a field-grade planner. But, regardless of who inputs MAAP data, the information must be retrieved quickly, easily, and without error. Any unfriendly computer system that slows the process will quickly be replaced by a Big Chief tablet.

5.2. Optimization and Decision Analysis

Two areas can be explored to speed MAAP planning:

- Use operations research to make targeting decisions for the NGAT Chief.
- Use operations analysis displays that allow quicker, more effective targeting decisions by the NGAT chief.

Targeting decisions are extremely complex. Factors such as target priority, terrain, weapon effectiveness, weapon system synergistic effects, forecast weather, and enemy threat are evaluated to maximize destruction. Asset limitations naturally constrain the effort to maximize force application. To the operations research professional, this may appear as yet another large scale linear program awaiting an accurate formulation. The JFACC planning tool is a formulation of this linear program.

Conversely, many seasoned veterans describe targeting as an art. Under identical conditions, no two air combat tacticians will develop the same targeting plan (10). If operational art exists in the targeting process, the artist may wish for help alliterating the drama, but does not want a computer to write the entire screenplay.

The author believes the targeting process is indeed an art. The dominant reason is the presence of numerous undocumented strengths, weaknesses, and limitations. These

may only be internalized by a person with abundant experience. Examples of unpublished factors may be:

- Flexibility in aircraft utilization
- Level of operational challenge required to meet "by-the-book" quantified levels of destruction
- Operational strengths and weaknesses among combat units

Moreover, a cursory study in military history will show that even the most quantified, well documented constraints, are flexible in war time.

A fruitful approach would bring displays to the planner allowing quick assessment of theater constraints and objectives. Ideally, as a tactician begins to devise a plan, operations research can be applied to show decision makers the critical strengths and weaknesses of a particular targeting scheme. It remains to be seen if linear programming can assist in this process.

The JFACC planning tool is an excellent product for research in linear optimization. Current products from JPT are available in spreadsheet form. These products might be compiled in a database, then manipulated by a tactician, to identify key areas in a targeting plan. It might be possible to integrate such a system into the present database of the DSS.

5.3. Recommendations for Future Research in the Current DSS

As stated earlier, to provide any analysis, the DSS must capture MAAP specifics quickly. Future research should concentrate on innovative and painless methods for a combat planner to enter targeting and scheduling data through the DSS. Also, any effort

to add additional MAAP attributes to the DSS must be accompanied by a hard look at ergonomic feasibility.

All DSS analysis is displayed in tabular form. Future research could attempt to absorb DSS analysis data into concise graphical displays. These displays would transpose time fields onto bar graphs placed over a 24 hour scheduling board. This would allow a tactician to more quickly identify utilization.

The DSS captures all needed data to assess the flow of strike packages. However, the current summary output is not grouped by time. Time and mission type sorting criteria should be added as an additional display to allow an easier picture of the package flow (19).

5.4. Summary

A decision support system now exists to capture the Master Air Attack Plan and provide an assessment against the JFACC guidance.

A DSS evaluation from the Chief, CENTAF Combat Plans: "Excellent job of taking what we view as an art and putting some useful science to it where it needed some help. That translation is a difficult project and you handled it with great acumen. I have spoken with the entire staff who each commented on the added value of the work you did and your professional performance. So, if we can get another student even approaching your skill, we'd love to support continued efforts in this vein. I think we are making progress thanks to you. " (21)

The DSS software is maintained at HQ ACC/XP-Studies and Analysis Squadron

(22). With an agreement to participate in further research, DoD organizations may receive copies of the software and the user's manual.

6. APPENDIX A: DSS User's Manual

**ACC/XP
Studies and Analysis Squadron**

**Decision Support System
(DSS)
for
JFACC
Combat Planning**

User's Manual

Maj Don Hinton

Executive Summary

This system allows assessment of the Master Air Attack Plan (MAAP) during construction and at completion. It is designed for use by the Guidance, Apportionment, & Targeting (GAT) cell of the JFACC combat plans staff. The force structure is loaded, then missions/strike packages are entered as they are planned. You can quickly enter mission data and assess utilization goals or constraints. Reports are available for post-planning analysis. A new user spends two hours, with this manual and a PC, to achieve required proficiency.

System Requirements

IBM compatible PC, Pentium processor, 16MB RAM, Windows 95,
MS Access 7.0

TABLE OF CONTENTS

I. OVERVIEW FOR PREVIOUS MS ACCESS USERS.....	40
I.1. COPY BLANK DATABASE AND RENAME.....	40
I.2. LOAD THE FORCE STRUCTURE.....	40
I.3. COPY DSS WITH THE FORCE STRUCTURE LOADED.....	40
I.4. ENTER STRIKE PACKAGES OR MISSIONS; ASSESS GOALS USING TOOLS...41	
I.5. AT THE END OF THE ATO DAY PLANNING CYCLE, PROTECT COMPLETED FILE.....	41
II. STEP BY STEP TUTORIAL.....	43
II.1. CREATE A WORKING FILE.....	43
II.2. START MS ACCESS.....	43
II.3. LOAD MISSION DATA.....	47
II.4. USING THE TOOLBAR.....	51
III. TOOLBAR BUTTONS.....	53
III.1. WHAT'S AVAILABLE?.....	53
III.2. WHAT'S FLYING?.....	55
III.3. WHAT'S FLYING VS WHAT'S AVAILABLE.....	57
III.4. TOTAL SORTIES PER UNIT.....	58
III.5. SUMMARY OF MISSION TYPE UTILIZATION.....	59
III.6. ALL SCHEDULED MISSIONS FOR ONE UNIT.....	61
III.7. ALL MISSIONS SCHEDULED, GROUPED BY PACKAGE.....	61
III.8. ALL MISSIONS SCHEDULED, GROUPED BY UNIT ID.....	61
III.9. AIR-TO-AIR REFUELING TRACK UTILIZATION EXPORT TO EXCEL.....	61
IV. TRAINING.....	62
V. ALIBIS.....	62

List of Figures

FIGURE 1 AIRCRAFT TYPES ENTRY FORM	45
FIGURE 2 COMBAT UNITS ENTRY FORM.....	46
FIGURE 3 COPYING THE DATABASE.....	47
FIGURE 4 PACKAGE DATA ENTRY FORM.....	48
FIGURE 5 MISSION TYPES DROPDOWN LIST	49
FIGURE 6 UNIT ID DROPDOWN LIST.....	50
FIGURE 7 VIEWING THE TOOLBAR	52
FIGURE 8 SELECTING THE TOOLBAR.....	53
FIGURE 9 TIME OF INTEREST PROMPT FOR WHATS AVAILABLE	54
FIGURE 10 RESULT DISPLAY FROM WHATS AVAILABLE	55
FIGURE 11 TIME OF INTEREST PROMPT FOR WHATS FLYING	56
FIGURE 12 RESULT DISPLAY FOR WHATS FLYING.....	56
FIGURE 13 RESULT DISPLAY FOR FLY VS AVAIL	57
FIGURE 14 RESULT DISPLAY FOR SORTIE/UNIT	58
FIGURE 15 MISSION TYPES SUMMARY.....	60

7. Overview for Previous MS Access Users

7.1. Copy blank database and rename

- A. Locate blank, read-only copy of *DSSBlank.mdb*
- B. Copy this file to your working directory.
- C. Rename the file to the designation for the first day's ATO.
- D. Remove the read-only property from your renamed file.

7.2. Load the Force Structure

- A. Open your file in MS Access
- B. Go to Forms
- C. Enter theater specific data in this order
 - 1. Mission Types
 - 2. AAR Tracks
 - 3. Friendly Bases (optional)
 - 4. AC Types and associated mission times
 - 5. Combat Units
- D. Program is now ready to load missions but, do **III** below first.

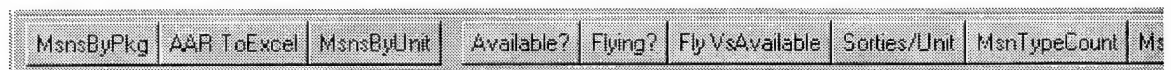
7.3. Copy DSS with the force structure loaded

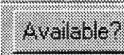
- A. Make copies for each future ATO day.
 - 1. *D+2.mdb*, *D+3.mdb*, etc.
 - 2. At next ATO planning cycle, change force structure as required for current ATO day:
 - a) Ute rate or attrition changes.
 - b) Units arrived or departed.
 - c) AAR track changes.


7.4. Enter Strike Packages or Missions; Assess Goals using Tools

A. Enter packages/missions using Package Data Entry Form(see tutorial)

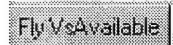
1. Use toolbar to assess:



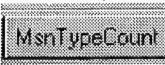
2. At any time of interest, what flights are available (re-armed) from a previous TOT. 

3. At any time of interest, total aircraft flying (tasked) from each unit. 

4. At any time of interest, a comparison of aircraft available (re-armed) and aircraft flying from each unit.



5. Total scheduled sorties against the UTE goals. 

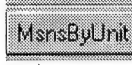
6. Fractional comparison, and count, of sorties scheduled against each mission type. 

7. Display all missions scheduled for any unit of interest.



8. Use toolbar to print instantaneous or final assessment reports:

B. List of all missions organized by package. 

C. List of all missions organized by unit. 

D. Print AAR Utilization to MS Excel file. 

7.5. At the end of the ATO day planning cycle, protect completed file.

A. Apply read-only property to completed file.



B. Print applicable final reports.

8. Step by Step Tutorial

8.1. Create a Working File

- A. Find the *DSSBlank.mdb* file and make a copy.
- B. This is the Decision Support System (DSS) with no data loaded. It is a blank database. This file is probably read-only so it cannot be corrupted. As a general rule, it is easier to populate a blank database than it is to delete records in a populated database. So, we start with a blank database file instead of trying to erase an older, used database file.
- C. Rename the copied file to associate with the first ATO day.
 - 1. If the first day of the ATO cycle is designated Alpha, name this copy accordingly; *ATOalpha.mdb*.
 - 2. During validation of this system, the first day's ATO was **D+1** so, it is renamed *D+1.mdb* . (Figure 3)
 - 3. Use whatever designation works for you.
- D. Remove the read-only property from your renamed DSS file.

8.2. Start MS Access.

- A. Open your DSS file.
- B. Take a look at the opening screen, particularly the tabs below:
- C.
- D. You should only be using the *Forms* tab. Take a look at the tables and queries if you like by clicking on the tabs but... DON'T ENTER ANY DATA from a table or a query or you may corrupt the file. The only tab you'll need is the  tab which will display the entry forms available to you.
- E. Click on the *Forms* tab.
- F. This display shows the forms required to enter data into the database.
- G. Most forms are self explanatory.

- H. You'll never use the *Missions Subform3*. It is incorporated into the *Package Data Entry Form*.
- I. Open the *MSN Types Entry Form*
 - 1. View all the mission types.
 - 2. If a mission type is not listed here, enter the new mission type in the blank field at the bottom of the page.
 - 3. Add/delete as required to complete a list of all mission types used.
 - 4. When complete, these mission types are the only fields available to you when assigning mission types to flights.
 - 5. Close the *MSN Types Entry Form*
- J. Open the *AAR Tracks Entry Form*.
 - 1. Enter the names of all AAR tracks.
 - 2. Close the *AAR Tracks Entry Form*.
- K. Open the *Friendly Bases Entry Form* (OPTIONAL).
 - 1. Enter any meaningful representation for friendly bases.
 - 2. Data from friendly bases is not used at this time.
 - 3. Close the *Friendly Bases Entry Form*.
- L. Open the *AC Types Entry Form* (Figure 1).
 - 1. Enter the aircraft type and use the tab button to move through each associated mission time.
 - 2. The hours and minutes entered in each field will be used to calculate when a flight of aircraft is available (or re-armed) for a new TOT. For example (see figure), the aircraft type entered is P51. *Long Hours* is 8, *Long Minutes* is 30. If you assign any flight of P51s to a long range mission, the DSS will show the flight re-armed and available 8 hours and 30 minutes after the first TOT.
 - 3. The aircraft types entered will be used to assign aircraft to combat units and missions. You must enter all possible aircraft types in the theater for the DSS to assign missions and combat units.
 - 4. Close the *AC Types Entry Form*.

Microsoft Access

File Edit View Insert Format Records Tools Window Help

MsnsByPkg AAR ToExcel MsnsByUnit Available? Flying? Fly VsAvailable Sorties/Unit MsnTypeCount Msn1Unit

AC Types Entry Form

Enter aircraft types and associated hour and minute values. See specific directions below.

TypeAC P51

TIMES

Very Long Hours 10

Very Long Minutes 15

Long Hours 8

Long Minutes 30

Medium Hours 5

Medium Minutes 45

Short Hours 2

Short Minutes 15

Print List of all AC Types

The time values are used to compute when an aircraft is available for a new TOT. For example, if you want the aircraft on a long range mission to be available

Form View

Figure 9 Aircraft Types Entry Form

- M. Open the *Combat Units Entry Form* (Figure 2).
1. Enter the unit ID designator. Limit the Unit ID to 8 characters. Each unit ID must be unique. You should be able to use the CTAPS unit ID. If you try to enter a unit ID that's identical to a unit already entered, you'll get an error message.
 2. Enter the unit's aircraft type in the *Type AC* field. Use the dropdown menu to pick the proper aircraft type. You may type this field via the keyboard, but it must be identical to an aircraft type entered earlier in the *AC Types Entry Form*. If you don't use the dropdown list and you mistype the aircraft type, the DSS may not perform proper calculations later.

3. Enter the number of aircraft assigned to the unit in the **#A/C In SQN** field. This is sometimes referred to as the Primary Aircraft Authorization (PAA).
4. Enter the UTE rate in the associated field.
5. (Optional) Enter the *Base* and *Country* fields.

The screenshot shows the Microsoft Access application window with the 'Combat Units Entry Form' open. The form displays a table with the following data:

Unit ID	Type AC	#A/C In SQN	UteRate	Base	Country
22FS	P51	24	6.3		
23FS	F4C	70	3.1		
24FS	P38	10	1.2		
25FS	P47	35	3.5		
26FS	F5	20	2.5		

The form also includes a record navigation bar at the bottom showing 'Record: 5 of 5' and a status bar at the very bottom with 'Form View' and 'CAPS NUM' indicators.

Figure 10 Combat Units Entry Form

- N. The DSS is now loaded with the theater assets. Loading the force structure can take some time but is only required once. Before using this file, make several copies for use on following ATO planning cycles. Then, as theater assets change, only slight alterations in the force structure will be entered at the beginning of the ATO planning cycle.
 1. Close the current database DSS file (Example: *D+1.mdb*).
- O. Note: It is not necessary to save an MS Access file before exiting. An open database is constantly saved by MS Access.

1. Locate your file in your working directory.
2. Copy the file.
3. Paste copies of the file into your directory.
4. Rename the copies to associate with ATO day designations (Figure 3).
5. Return to MS Access and open the DSS file for ATO day one.

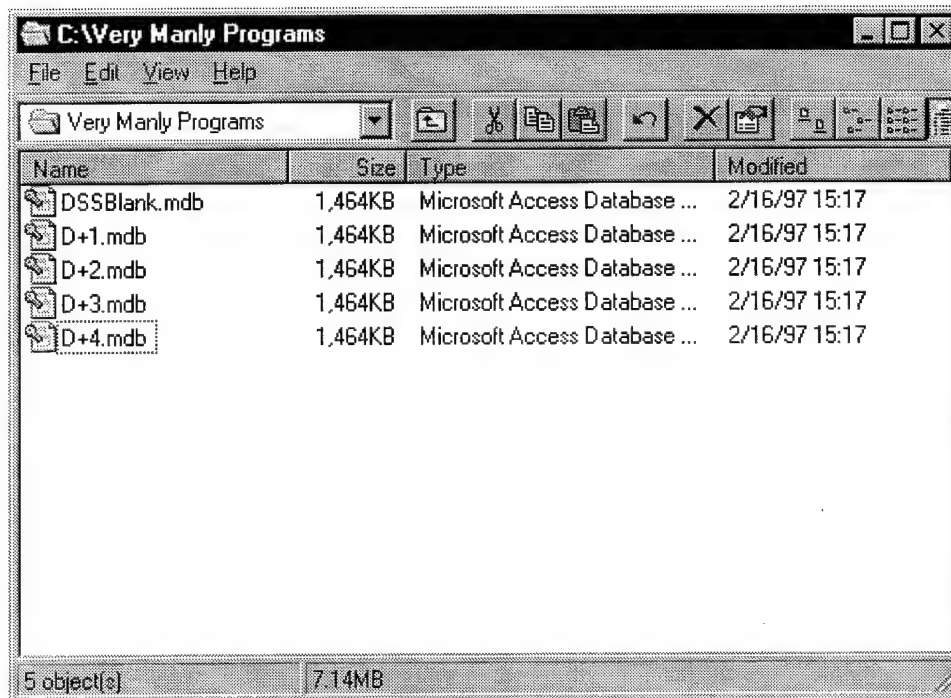


Figure 11 Copying the Database

8.3. Load Mission Data

- A. Load missions as they are planned by opening the *Package Data Entry Form* (Figure 4). This is the form used most. This form allows the user to assign aircraft to strike packages.
- B. Using the *Next Pkg/Prev Pkg* buttons, scroll to the 2 letter identifier for your package. For example, if you want to build package AF, click on *Next Pkg* until the *Package ID* field reads AF.
- C. Enter the suffix to the *Package ID* field. YOU MUST enter the completed *Package ID* field before assigning specific flights to

a package. Click inside the *Package ID* field and position the cursor to the right of the 2 letter identifier. Type the 1 letter suffix. The *Package ID* field is limited to 3 characters.

Microsoft Access

File Edit View Insert Format Records Tools Window Help

MsnByPkg AAR ToExcel MsnByUnit Available? Flying? Fly VsAvailable Sorties/Unit MsnTypeCount Msn1Unit

Package Data Entry 4

Package Form

Package ID: AA

Print Form

YOU MUST ENTER "PACKAGE ID" BEFORE ENTERING MISSIONS

PrevPkg NextPkg

MSN Types	TgtNumber	TOT	Unit ID	NumAC	TypeAC	AAR Trak	Range	Cor
	50			4				

Notes to ATO Development: W C E AWACS (Circle One)

Coord: WPNS / SEAD / DCA / RECCE / TNKR / SCHED / GAT Chief /

Record: 1 of 104

Form View CAPS NUM

Figure 12 Package Data Entry Form

1. (Figure 5). Use the dropdown list or type the first letter of the mission type.

Microsoft Access

File Edit View Insert Format Records Tools Window Help

MsnsByPkg AAR ToExcel MsnsByUnit Available? Flying? Fly VsAvailable Sorties/Unit MsnTypeCount Msns H

Package Data Entry 4

Package Form

Package ID: AAF

Print Form

YOU MUST ENTER "PACKAGE ID" BEFORE ENTERING MISSIONS

Missions

MSN Types	TgtNumber	TOT	Unit ID	NumAC	TypeAC	AAR Trak	Range	Cont
AI	50			4				
CAS								
DCA								
ESC								
EW								
INT								
OCA								
Other								

Comment: W C E AWACS (Circle One)

Coord: WPNS / SEAD / DCA / RECCE / TNKR / SCHED / GAT Chief /

Record: 1 of 104

Form View

Figure 13 Mission Types Dropdown List

2. Enter the target number. This field is NOT intended for a designated mean point of impact (DMPI). Type the number or use the dropdown list. The default value is 50. If there is no target number for a mission (i.e., a DCA or ESC mission), make the target number field blank by deleting the number 50 when you tab through the field.
3. Enter the TOT in military time. The colon appears in the field, but is not typed. For example, a TOT at 2115 is entered as 2115 but appears as 21:15. If you enter an invalid time (i.e., 2175), you'll be prompted to correct the entry.

4. Enter the unit ID (Figure 6). Use the dropdown list to display all units and aircraft types. When you select a unit from the dropdown list, the aircraft type is automatically entered in the appropriate field.

Microsoft Access

File Edit View Insert Format Records Tools Window Help

MsnsByPkg AAR ToExcel MsnsByUnit Available? Flying? Fly VsAvailable Sorties/Unit MsnTypeCount Msns 1Unit

Package Data Entry 4

Package Form

Package ID: AAF

PrevPkg NextPkg

Print Form

YOU MUST ENTER "PACKAGE ID" BEFORE ENTERING MISSIONS

Missions

MSN Types	TgtNumber	TOT	Unit ID	NumAC	TypeAC	AAR Trak	Range	Com
	50	09:15		4				
*	50		22FS	P51				
			23FS	F4C				
			24FS	P38				
			25FS	P47				
			26FS	F5				

Notes to ATO Development: W C E AWACS (Circle One)

Coord: WPNS / SEAD / DCA / RECCE / TNKR / SCHED / GAT Chief /

Record: 1 of 104

Form View

CAPS NUM

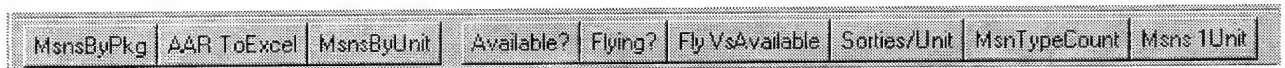
Figure 14 Unit ID Dropdown List

5. Enter the number of aircraft assigned to the flight/mission. Use the dropdown list or type the number. The default number is 4.
6. Skip, or tab through, the aircraft type field as it is already completed when the unit ID is entered.
7. Enter the AAR track from the dropdown list. This field may be left blank.
8. Enter the *Range* field. The values are Short, Med, Long, and Very Long. This is a required field. If you don't enter a value, you'll receive an error message. As soon

as you enter a range value you'll notice the *TimNextTOT* field being updated.

9. Enter any required comments. This field allows you to enter a large amount of text, but only the first few words are visible on reports. All comments are viewed by entering the comment field and using the right/left arrow keys to scroll through the comments.
10. Use the tab key to go through the *TimNextTOT* field. This field is calculated automatically based on parameters entered earlier. When you tab through the *TimNextTOT* field, the cursor will start a new line.
11. When the cursor begins a new line, you can continue entering missions or use the toolbar (next section) for assessments. Always INSURE the cursor is at the left side of the line, in the *Msn Types* field, before using the toolbar.

8.4. Using the Toolbar.



If the toolbar above is not in view, select **View**, then **Toolbars** (Figure 7).

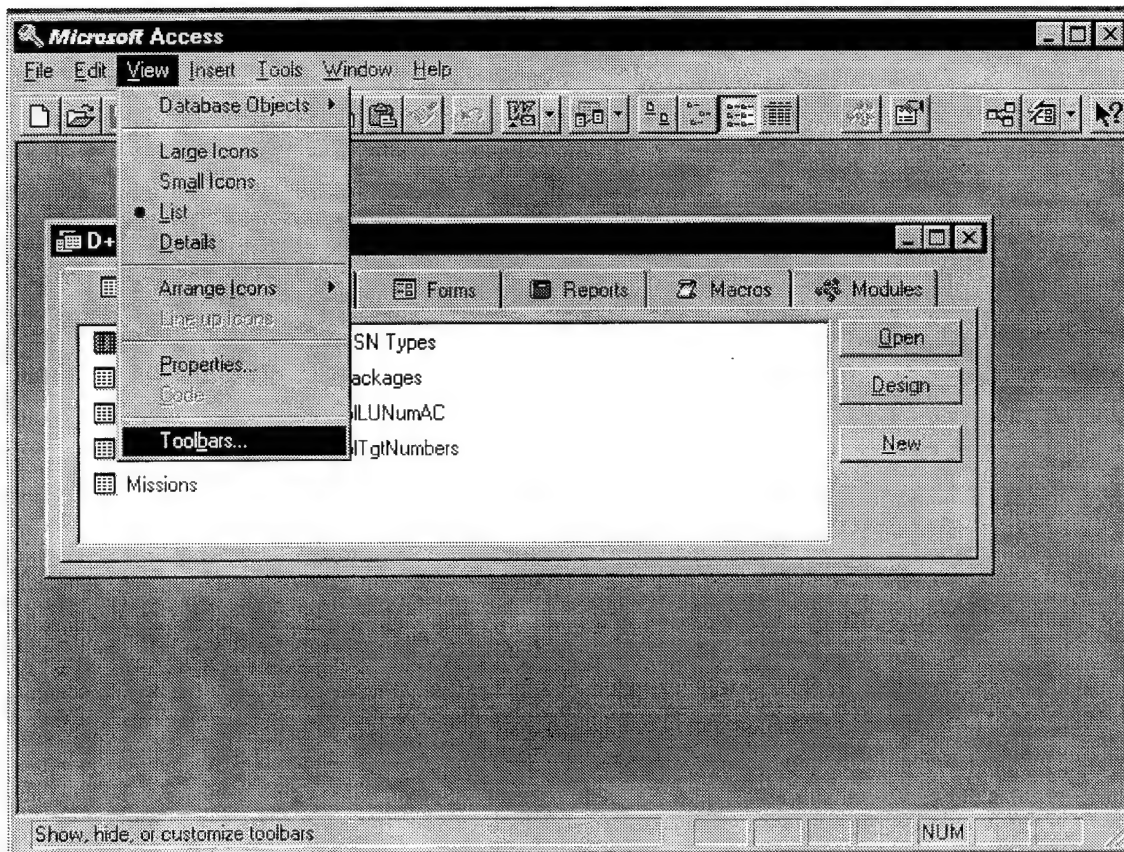


Figure 15 Viewing the Toolbar

On the list of toolbars, scroll through the list to find the Query and Report toolbars. Click in the box next to each putting a check inside the box (Figure 8). Select **Close** and the toolbars appear at the top of the screen.

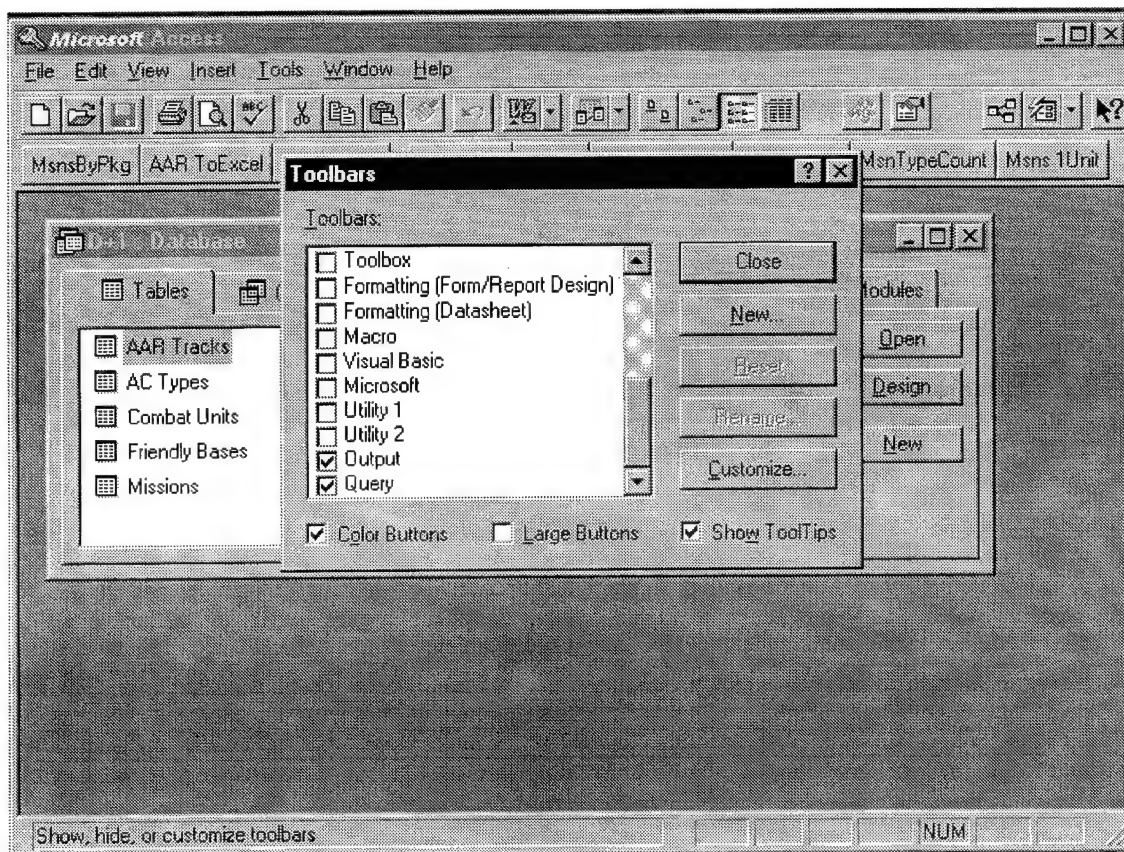


Figure 16 Selecting the Toolbar

9. Toolbar Buttons

9.1. What's Available?

Available? This tool displays all missions available (re-armed) within 2 hours of the time you enter. When you click on this button, a window will appear prompting you for a time (Figure 9). Enter your time of interest **using a colon** between the hours and minutes. The display appears immediately. If you enter an incorrect time value (i.e., 21:75), you'll get an error message. At the error message, Click OK. Then click Halt. Re-attempt your assessment by clicking the tool button again.

Insert Format Records Tools Window Help

R ToExcel MnsByUnit Available? Flying? Fly VsAvailable Sorties/Unit Ms

Data Entry 4

Enter Parameter Value ? X

Enter Time for Whats Available

12:40

OK Cancel

types	TgtNumber	TOT	Unit ID	NumAC	TypeAC	AAR To
	54	12:20	5FS	2	F117	Tangerin
	56	12:20	2BSQN	3	B52	Grape
		12:10	4FS	4	F1	Grape

Figure 17 Time of Interest Prompt for Whats Available

The result displays missions/flights that have become available within 2 hours of the time entered (Figure 10). Note that each line of this display is a flight previously scheduled. Also shown are the sorties scheduled and remaining for each unit. The sorties scheduled and remaining is associated with each unit and is equivalent for all flights from the same unit. When finished viewing the display, close the window to return to the *Package Data Entry Form*.

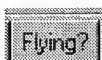
MsnsByPkg	AAR ToExcel	MsnsByUnit	Available?	Flying?	Fly VsAvailable	Sorties/Unit	MsnTypeCount	Msns 1Unit
-----------	-------------	------------	------------	---------	-----------------	--------------	--------------	------------

Avail After : Select Query						
	EarliestNextTOT	Unit ID	NumAC	TypeAC	UnitSortiesRemain	Sorties Scheduled
	10:50	13FS	4	F16CG	40.0	20
	10:50	13FS	4	F16CG	40.0	20
	11:10	23FS	4	P39	24.0	12
	11:10	23FS	4	P39	24.0	12
	11:15	23FS	4	P39	24.0	12
	11:20	20FS	4	P51	16.4	16
	11:20	12FS	4	F16C	40.8	12
	11:30	VFMA335	4	F18C	20.0	4
	11:30	7FS	4	F14	0.8	12
	11:30	24FS	4	P38	32.0	4
	11:30	16FS	4	F4E	40.8	12
	11:35	21FS	4	P47	24.0	16
	11:50	1FS	4	EF111	25.0	11
	12:10	16FS	4	F4E	40.8	12
	12:15	21FS	4	P47	24.0	16
	12:15	21FS	4	P47	24.0	16

Datasheet View	CAPS	NUM
----------------	------	-----

Figure 18 Result Display from Whats Available

9.2. What's Flying?



This tool displays total aircraft flying (or tasked) in each unit at the time of interest. When you click on this button, you're prompted to enter your time of interest (Figure 11). Enter the time **with a colon** between the hours and minutes.

ToExcel MsnByUnit Available? Flying? Fly Vs Available Sorties/Unit MsnT

Enter Parameter Value

Enter Time for Whats Flying

ARF 12:40

OK Cancel

pes	TgtNumber	TOI	UnitID	NumAC	TypeAC	AAR Trak
	54	12:20	5FS	2	F117	Tangerin
	56	12:20	2BSQN	3	B52	Grape
		12:10	4FS	4	F1	Grape
		12:10	4FS	4	F1	Grape
		12:10	6FWS	8	F4ER	Grape

Figure 19 Time of Interest Prompt for Whats Flying

Total tasked aircraft is assessed against the number of aircraft in the squadron (PAA) and the fractional percentage of a unit's PAA (Figure 12). Close the display when finished.

Total Flying wPercent : Select Query

Unit	TypeAC	NumFlying	%PAA Flying	#AircraftInPAA
10FS	F15C	12	50%	24
11FS	F16C	12	67%	18
13FS	F16CG	12	50%	24
14FS	F16CG	16	67%	24
16FS	F4E	4	17%	24
17FS	F5E	8	36%	22
18FS	JAGUAR	14	64%	22
19FS	P61	8	50%	16
1BSQN	B1	5	42%	12
1FS	EF111	7	58%	12
20FS	P51	12	67%	18
21FS	P47	4	20%	20

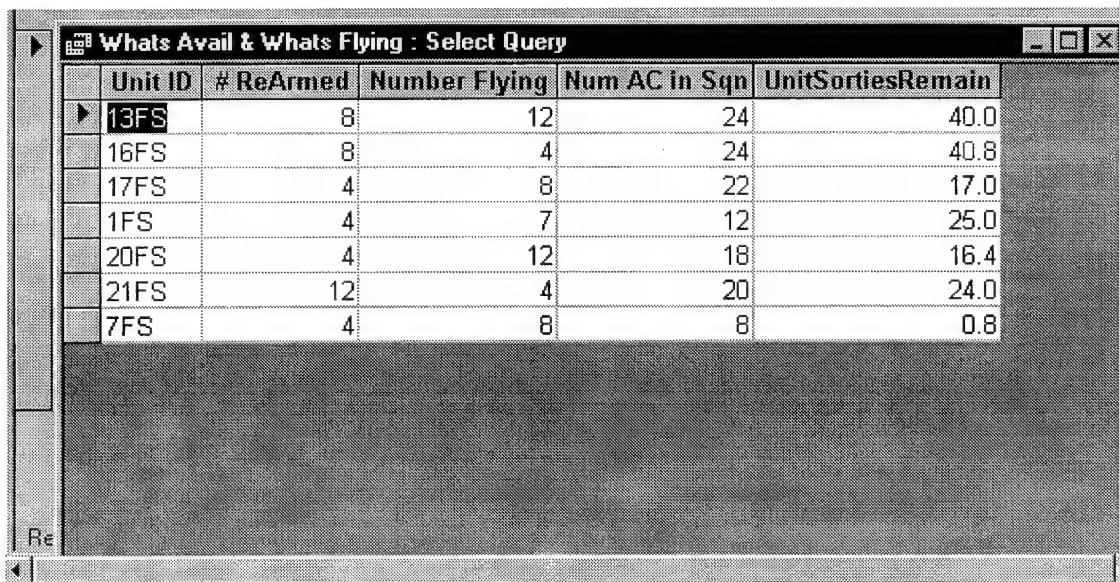
Record: 1 of 22

Figure 20 Result Display for Whats Flying

9.3. What's Flying vs What's Available

Fly Vs Available

This tool is a comparison of the data from the two assessments described previously, and . This tool will force you to enter the time of interest twice, then display results. Unit data is only displayed if unit aircraft have become available (re-armed) within 2 hours AND the unit has aircraft currently tasked at the time of interest. Results are shown below. (Figure 13)



Unit ID	# ReArmed	Number Flying	Num AC in Sqn	UnitSortiesRemain
13FS	8	12	24	40.0
16FS	8	4	24	40.8
17FS	4	8	22	17.0
1FS	4	7	12	25.0
20FS	4	12	18	16.4
21FS	12	4	20	24.0
7FS	4	8	8	0.8

Figure 21 Result Display for Fly vs Avail

9.4. Total Sorties per Unit

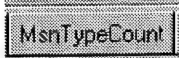
Sorties/Unit This tool displays total sorties scheduled and remaining. The UTE rate is used to compute maximum sorties. (Figure 14)

Unit	TypeAC	Scheduled	Remaining	Max Sorties	#AircraftInPAA
10FS	F15C	20	40.0	60.0	24
11FS	F16C	12	34.8	46.8	18
12FS	F16C	12	40.8	52.8	22
13FS	F16CG	20	40.0	60.0	24
14FS	F16CG	16	44.0	60.0	24
15FS	F4E	4	48.8	52.8	24
16FS	F4E	12	40.8	52.8	24
17FS	F5E	16	17.0	33.0	22
18FS	F5E	4	40.0	44.0	22
18FS	JAGUAR	14	30.0	44.0	22
19FS	P61	12	20.0	32.0	16
1BSQN	B1	5	7.0	12.0	12
1FS	EF111	11	25.0	36.0	12
20FS	P51	16	16.4	32.4	18
21FS	P47	16	24.0	40.0	20

Record: 1 of 28

Figure 22 Result Display for Sortie/Unit

9.5. Summary of Mission Type Utilization



This tool displays the number of sorties scheduled against each mission type. Also displayed is the percentage of total sorties scheduled against the mission type (Figure 15). The data appears on the screen but is most easily viewed in printed form. The printed form will display the date/time of printing so multiple copies may be distinguished throughout the planning cycle. The display is sent to the printer by clicking the normal Print icon. Close the display when finished.

Mission Types Report

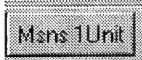
MSN Types		# A/C
<u>AI</u>	Sum	40
	Percent	12.58%
<u>DCA</u>	Sum	38
	Percent	11.95%
<u>ESC</u>	Sum	56
	Percent	17.61%
<u>EW</u>	Sum	27
	Percent	8.49%
<u>INT</u>	Sum	97
	Percent	30.50%
<u>OCA</u>	Sum	40
	Percent	12.58%
<u>SA</u>	Sum	5
	Percent	1.57%
<u>SEAD</u>	Sum	7
	Percent	2.20%
<u>WW</u>	Sum	8
	Percent	2.52%
Total Sorties		318

11-Mar-97 22:53

Page 1 of 1

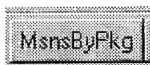
Figure 23 Mission Types Summary

9.6. All Scheduled Missions for One Unit



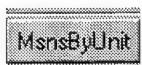
This tool displays all missions scheduled for a single unit. When you click on this button, you're prompted to enter a Unit ID. The display is self explanatory.

9.7. All Missions Scheduled, Grouped by Package



This tool prints a list of all scheduled packages showing unit ID, mission type, target number, TOT, number & type aircraft, and the first line of the comments field. Each page is numbered and annotated with the date/time of the printing. During the planning process, a printed copy is periodically generated for intermediate analysis. At completion of the MAAP, copies are printed for analysis by the ATO Development staff. During a CTAPS failure, this copy could be faxed as a skeleton ATO.

9.8. All Missions Scheduled, Grouped by Unit ID



This tool prints a copy of missions assigned to each unit. These pages provide additional analysis of unit tasking. During a CTAPS failure, this copy could be faxed as a unit tasking order.

9.9. Air-to-Air Refueling Track Utilization Export to Excel



This tool exports the AAR utilization report. After clicking on this button, a screen will prompt the user to specify in which directory to place the report. The report shows utilization times in ascending order of

AAR tracks by unit ID, number and type aircraft. This data is used for analysis by the AAR manager in the GAT cell.

10. Training

Follow the manual and create a small, bogus air force to use as an unclassified training aid. Then assign missions to packages and use the toolbar to see how the assessments change as missions are entered.

As you gain proficiency, purposely make input errors to become comfortable recovering. Also, steadily increase the tasking of a particular unit and observe the changes in the toolbar assessment displays. Use the *Available?*, *Flying?*, *Fly VsAvail*, and *Sorties/Unit* tools to determine which unit to task at a particular time.

11. ALIBIs

SECURITY

- When using this system, almost anything you print will be classified. It is the **USER'S RESPONSIBILITY** to properly mark and secure all printed material from this system.
- The system software is unclassified, as delivered, in read-only form.

Package Data Entry Form

- If you forget to type the *Package ID* suffix before inputting mission lines, complete entering data on mission lines, then go to the *Package ID* field, enter the suffix, hit return (data will disappear but is actually saved), and close the form. When you reopen the form, scroll to the package ID using the *NextPkg* button, and you'll see the package is entered properly.
- If you start a line and decide you don't need it, complete the line with bogus data, then highlight the entire line and delete it.
- If, while entering data on a mission line, you fat-finger the cursor onto another line, you'll get an error message prompting you to enter the range field before leaving the line.
- If you need to change some data in a previously entered package, tab through all the fields on the line.

- If you enter a bogus *Unit ID* or *Type AC*, you'll get a run-time error when the program looks for that aircraft in the data base. Just click End, and reenter the data correctly.

Package IDs

- If you'd like to group some support sorties together, assign them all to a 3 letter package ID. The X** package IDs are used for this. For example, non-packaged SEAD support could be packaged as XWW. If you want to create your own package IDs, go to tables and open the Packages table and enter the 3 letter ID. Insure you don't enter an ID that might later be assigned to a strike package. For example, don't use ABC as an identifier for ABCCC sorties because the AB package may be assigned a C suffix.

Combat Units Entry Form

- When finished loading the combat units for the theater, you can use the print icon to create a hard copy. The form looks good on the monitor but the printed form looks lousy. Its legible. Sorry.

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Shaw AFB, SC, 7 March 1997

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13. Vita

Major Donald W. Hinton was born 25 February 1958 in Raytown, MO. He graduated from Raytown High School in 1976 and entered undergraduate studies. After a few years in night school while employed in various industries, he graduated with a Bachelor of Science degree in Electronic Engineering Technology in March 1983 from Weber State University at Ogden, Utah. He received his commission at Officer Training School on 9 September 1983. Upon completion of Undergraduate Pilot Training, Major Hinton was assigned as an F-16 pilot to the 310 TFTS, 430 FS, 428 FS, and 85 TES. He served with the US Army 1st Infantry division as an AF liaison officer prior to his assignment at AFIT.

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Raytown, MO 64133

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
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4. TITLE AND SUBTITLE A Decision Support System for Joint Force Air Component Commander (JFACC) Combat Planning		5. FUNDING NUMBERS		
6. AUTHOR(S) Donald W. Hinton, Major, USAF				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Air Force Institute of Technology/ENS 2950 P Street AFIT/GOA/ENS/97M-09 Wright-Patterson AFB, Ohio 45433-7765		8. PERFORMING ORGANIZATION REPORT NUMBER		
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GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to *stay within the lines* to meet optical scanning requirements.

Block 1. Agency Use Only (Leave blank).

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

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